IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:	Konczal, Michael T.	Docket No.:	P-202
Serial No:	10/609,101	Art Unit:	2632
Filed:	June 30, 2003	Examiner:	Davetta W. Goins

For: **Deceleration-Activated Safety Light**

September 29, 2004

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

> I hereby certify that this paper is being deposited with the U.S. Postal Service as first class mail with sufficient postage addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this date: 09/29/04
>
> Michael T. Konczal

DECLARATION UNDER 37 C.F.R § 1.131

I, Michael T. Konczal, declare under penalty of perjury that:

1. I am the inventor of claims 1-20 of the above-identified patent application.

2. Prior to December 27, 1999, in the U.S.A., I conceived the deceleration-activated safety light as described and claimed in the above-identified patent application. A *Critical Design Report*, dated "7/21/99", and a *Final Project Report* dated "8/10/99", each with accompanying diagrams, (attached hereto as Exhibits A and B respectively), were prepared by me and submitted on the dates respectively indicated thereon to others in fulfillment of the requirements of an (unpublished, uncataloged) independent design project undertaken for credit pursuant to my education in Electrical Engineering at the University of Texas at Dallas.

3. I diligently continued to evaluate and test the invention, and in due course prepared and filed the instant patent application.

Michael T. Konczal 09/29/04
Michael T. Konczal

Exhibit A
10/609,101
09/29/04

Critical Design Report

EE 4380

Motorcycle Helmet Containing Deceleration-Activated Brake Light

Mike Konczal

7/21/99

1. Objective

The goal of this project is to design and test a brake light switch that is activated by deceleration. An additional objective is to make the device portable enough for use on a motorcycle helmet.

This device is intended to be an improvement on the present state of the art for brake lights, which use an external switch input (brake pedal) to activate a brake light. The present art for the helmet-mounted brake light is nonexistent.

2. System Specifications

2.1 Sensitivity

The device should be sufficiently sensitive to activate a brake light almost instantaneously under decelerations of one mile per hour per second. This is sensitivity on the order of 5 mG. This level of sensitivity is believed to be required in order for the device to be useful in applications equivalent to day-to-day traffic.

The sensitivity of the device should be sufficiently controlled to avoid activation of the brake light by decelerations other than that relative to the forward motion of the device. E.g.; Activations due to turns, bumps, head movements, are to be minimized.

The following three specifications relate to portability. They would not be as important if the device were to be employed strictly in vehicles, but they are relevant to use in a motorcycle helmet.

2.2 Size

The size of the device should be no larger than (4 x 6 x ½) inches for all components, including power source, circuitry, and light source. Meeting this specification will ensure that the device is small enough for the intended application.

2.3 Weight

The weight of the device, including batteries, should be no more than 4 ounces in order to keep the weight of a motorcycle helmet with the device installed roughly comparable to a helmet with no device installed.

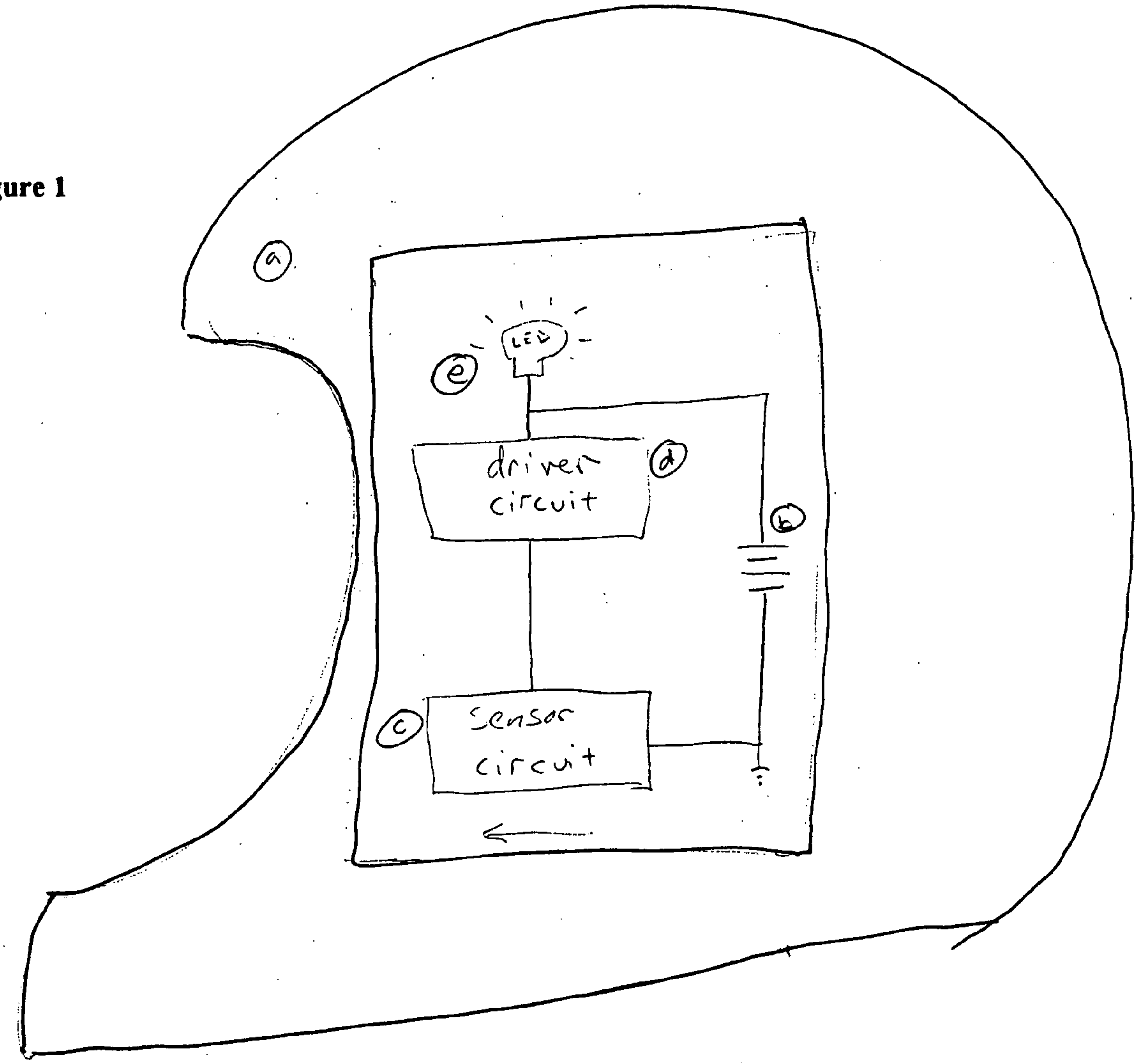
2.4 Durability

The device should be capable of operation under conditions reasonably anticipated in normal use. Primarily this means that the device should be capable of withstanding drops from a height of approximately three feet, and to operate in temperatures ranging from approximately 40 to 100 degrees Fahrenheit.

3. System Design

The system will consist of three major component groups: sensor circuitry; light and driver circuitry; power supply. The entire device will be constructed as a self-contained unit for affixing to a conventional motorcycle helmet. In a commercial product it would be possible to incorporate the components into the helmet design. Figure one depicts a small block diagram for the device showing its intended application to a conventional motorcycle helmet.

Figure 1



A conventional motorcycle helmet **(a)**. A battery, or series of batteries, provide power. **(b)**. The sensing circuit **(c)** will employ a commercially available accelerometer oriented to measure acceleration along the axis from front-to-rear of the helmet. The sensing circuit is further described below. The driver circuit **(d)**, also described below, will perform the necessary logic to distinguish real from false signals and activate the light source as appropriate. **(e)**.

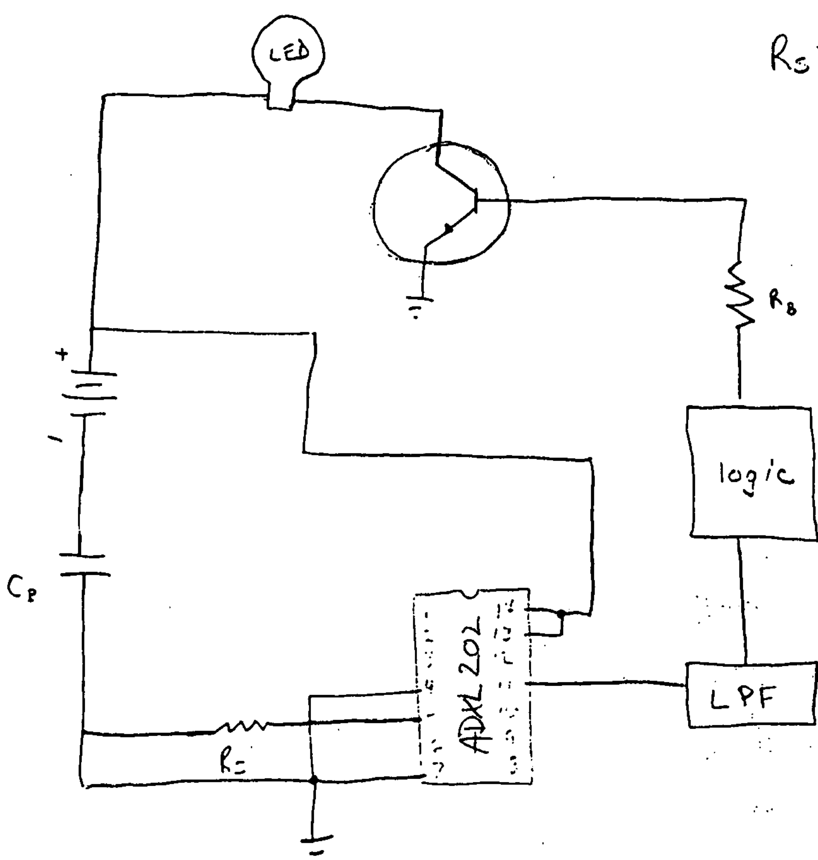
4. Circuit Design

The preliminary circuit design involves using the analog output of an accelerometer designed to measure acceleration. The analog output must then be used by the driver circuit to determine whether the light source should be switched on. Figure 2 shows the circuitry for the device.

Figure 2.

$$R_B = \frac{V_{in} - (.7)}{2\, I_{LED}}$$

$$R_S = \frac{125\ M\Omega}{T}, \quad T \equiv \text{period of [illegible]}$$



5. Key Tasks

a. Assemble circuit for breadboard testing.

- select parts
- determine component values
- test the circuitry in a laboratory environment

b. Critical Design Review

c. Testing in a mobile environment.

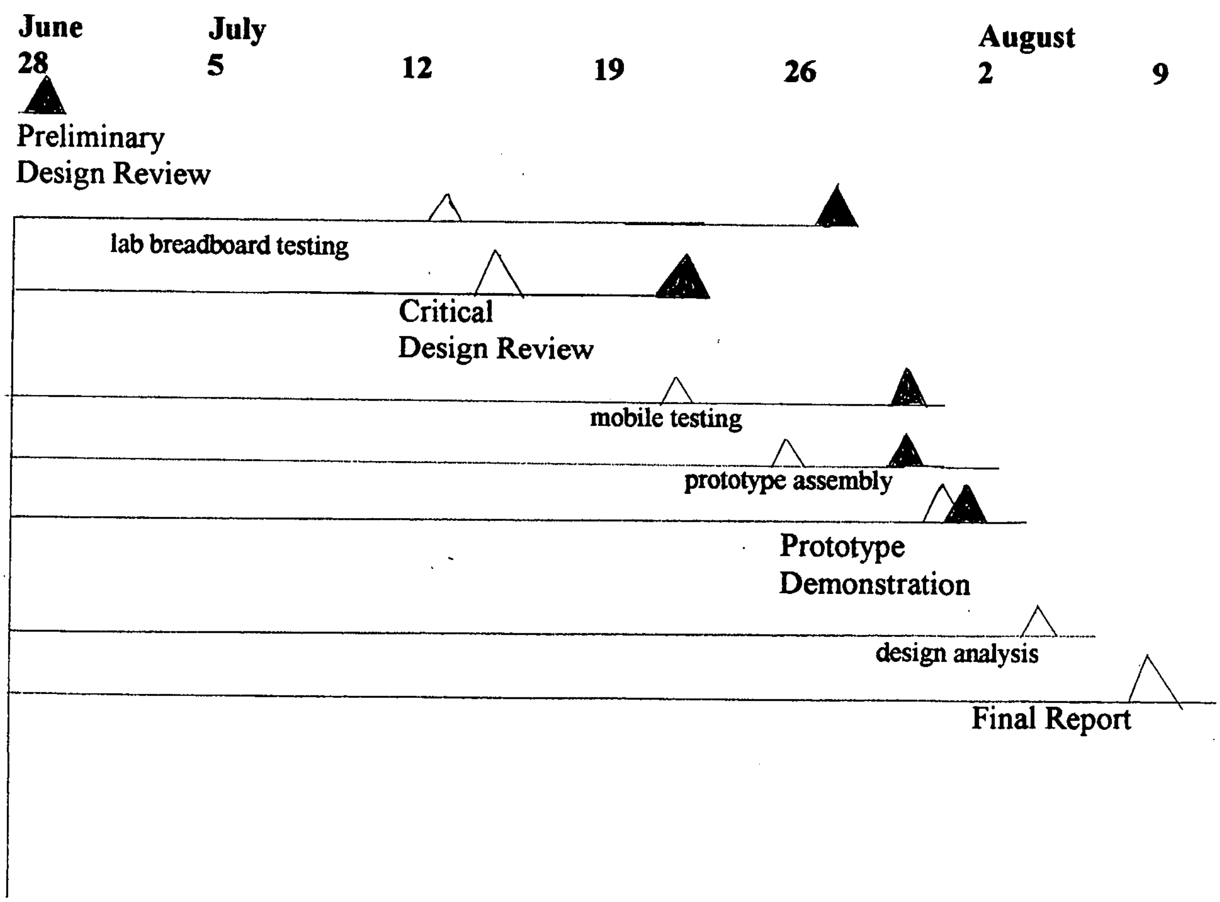
- Take breadboard in a car and test operation
- Correct any apparent design errors

d. Assemble device on a circuit board and attach to headwear for real-world testing.

e. Prototype Demonstration

f. Final Report

6. Task Schedule



7. Resource Analysis

The Analog Devices ADXL202 chip has been selected for use as the accelerometer. Based on its specification sheet [Appendix A], the ADXL202 appears, in theory, to be sensitive enough for the intended circuit.

Based on the specification sheet information, several capacitors, resistors, batteries, and light emitting diodes will be required for the circuit. The component values will be calculated and adjustments made during the laboratory testing.

The light source will consist of an array of red LEDs. LEDs were chosen because of their small size and low power consumption relative to incandescent bulbs.

8. Budget

The project budget is expected to be trivial due to the generosity of Analog Devices in provided two free samples of their very recently released ADXL202. The passive components, including LEDs of the circuit are expected to cost less than $20.00. Items purchased for testing to date include LEDs, miscellaneous resistors and capacitors, circuit board, battery terminals, batteries. Total cost for components purchased is eight dollars and thirty six cents ($ 8.36). It is possible that additional components may be required to implement design changes.

9. Key Issues/Potential Problems

The success of the device contemplated hinges on appropriately controlled sensitivity of the sensing circuitry. The desired sensitivity appears to be at the edge of the envelope of current accelerometer technology. The circuit needs to be sensitive enough to be useful, yet "smart" enough to minimize false signals.

The initial breadboard testing is intended to permit testing the circuit in a carefully controlled environment. The circuit has been assembled and tested in the form shown in figure 2. Despite alterations in the inverting op amp feedback resistor to increase the gain, and changes in the X and Y axis filter capacitors, the circuit has not been capable of detecting decelerations produced by manual movement of the breadboard in the lab. Filtering or using logic to ignore signals other than deceleration relative to the forward axis have not been attempted at this point. All efforts have been directed toward simply getting some type of signal in response to changes in acceleration. More modifications to the circuit will be attempted. Also, in the event that the decelerations produced in the lab are too weak to activate the device, the breadboard will be taken out for mobile testing where decelerations up to 60 → 0 mph over time span on the order of 5 to 10 seconds can be attempted.

Exhibit B

10/609,101

09/29/04

Final Project Report

EE 4380

Motorcycle Helmet Containing Deceleration-Activated Brake Light

Mike Konczal

8/10/99

1. Project Goal

The goal of this project was to design and test a brake light activated by deceleration. An additional objective is to make the device portable enough for use on a motorcycle helmet.

This device is intended to be an improvement on the present state of the art for brake lights, which use an external switch input (brake pedal) to activate a brake light. The present art for the helmet-mounted brake light is nonexistent.

2. Project Approach

The approach to this project was to use a self-contained accelerometer designed for measuring acceleration in order to generate a signal from deceleration. The signal is then used to switch on a brake light, which remains on during acceleration. The Analog Devices ADXL202 accelerometer was chosen. The ADXL202 is a 2-axis accelerometer with a measurement range of plus or minus 2 g. An analog output proportional to acceleration is available from the chip. The manufacturer purports that the sensor is capable of resolution down to 5 mg. In breadboard testing, a negative voltage was received from the chip during relatively mild decelerations. An inverting op amp circuit was used to convert the signal into sufficient current to drive an LED. A Schmitt trigger was added to introduce a delay, giving a steadier signal.

3. Schedule Summary

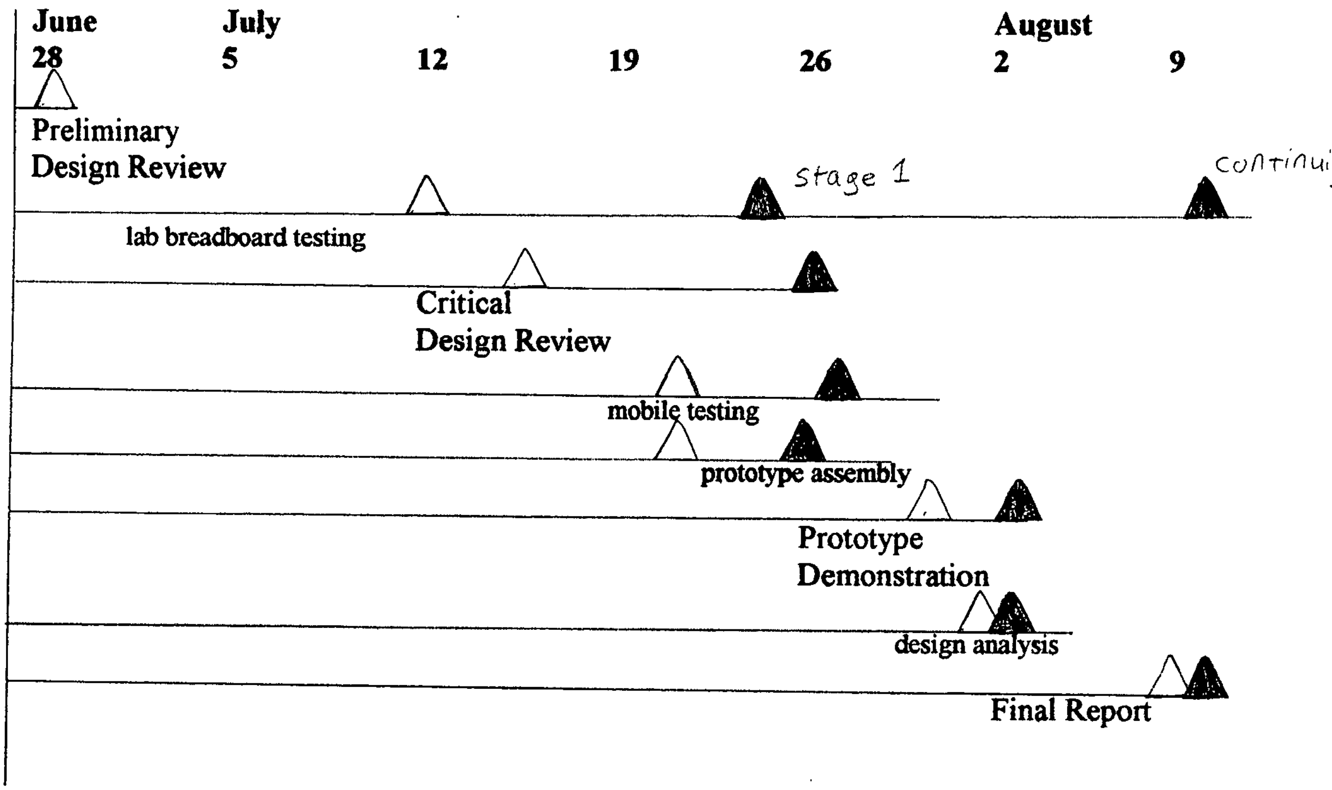
The following key tasks were identify in order to regulate the timely flow of the project. All were completed successfully.

a. Assemble circuit for breadboard testing.

b. Testing in a mobile environment.

c. Assemble device on a circuit board and attach to headwear for real-world testing.

Task Schedule



4. Budget Analysis

The project budget was initially expected to be modest. During the preliminary search for available sensors, it was learned that accelerometers ranged in price from \$39.95 for off-the shelf components to in excess of \$1,000.00 for custom components. Fortunately, Analog Devices provided two free samples of their very recently released ADXL202, as well as older model sensors of lesser sensitivity. The passive components, including LEDs were expected to cost less \$20.00. The project was completed for less than expected. The op amp, Resistors, capacitors, LEDs, circuit board, and batteries cost a total of eight dollars and eighty-nine cents (\$ 8.89). Additional costs of five dollars and seventy-six cents (\$5.76) were incurred for additional LEDs and NE555's used in attempting improvements. Using miscellaneous equipment on hand such as solder, wire,

tools, power supplies and test equipment, spared some expenses. The total cost of the project was fourteen dollars and sixty-five cents ($14.76).

5. Results Summary and Analysis

The circuit was initially successful to a degree but required a jolt, however slight, during deceleration in order to produce a signal strong enough to produce the desired result. Gentle decelerations with no accompanying jolt were insufficient. It was suggested that the circuit might be improved by the addition of a delay, such might be obtained with a Schmitt trigger. A Schmitt trigger using an NE555 and passive components was built on the breadboard and was successful. The passive components were chosen to give an approximately 1.85 second delay. This delay also seemed to help reduce the requirement that the sensor receive a jolt, probably due to the gain of the Schmitt trigger circuit, which switched on the LED at the slightest provocation. Attempts to implement the Schmitt trigger on the prototype were unsuccessful. The circuit is the same as that used on the breadboard. The problem is probably due to faulty soldering or a bad component. Given sufficient time, these difficulties could be resolved. It was also suggested, and desirable, that the indicator light be increased to an array of LEDs by using a chip such as the MC1413 to increase the fan-out of the circuit. This improvement was also not accomplished due to the unavailability of an MC1413 or equivalent in the time allotted.

6. Project Assessment

The original idea behind the project was to develop an invention simple enough to complete in one semester, yet novel enough to be patentable. These goals were met. The project was successful as a prototype proving the viability of the concept. Although the

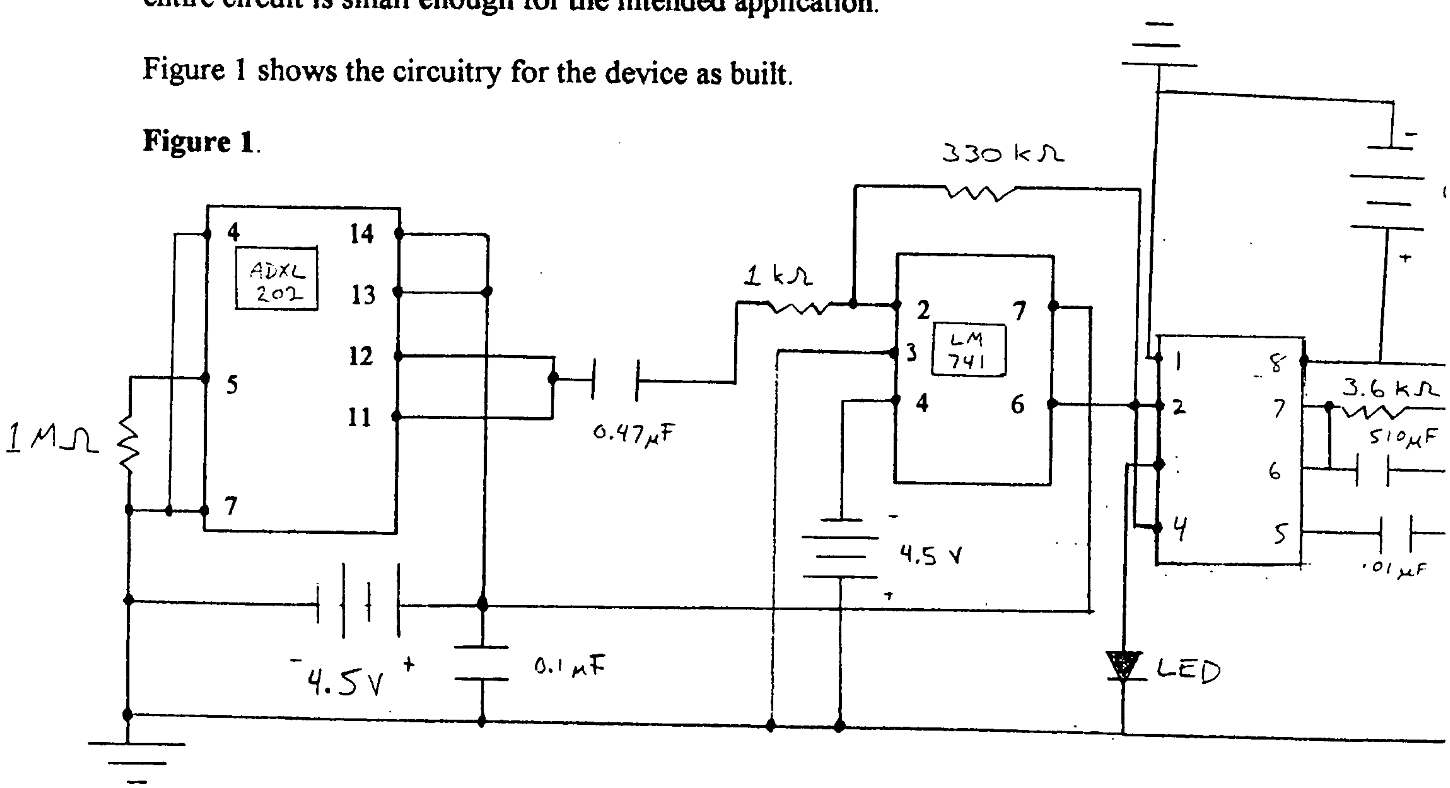
circuit components are off-the-shelf, this particular application has not been done before. The device therefore meets the novelty test for patentability. The project was also a success in terms of my personal goal to see the patent process from an inventor's point of view. Although time did not permit drafting a patent application, I intend to pursue this as a review exercise as I study for the patent bar exam in November.

The prototype is not capable of performing at the level originally envisioned, but rather points the way toward the possibility for future development. As mentioned above, the amplifier portion of the circuit could be improved to allow for the use of more LEDs. Sensitivity was expected to be a major issue, and it was indeed. The device functions well when deceleration occurs over a short time period but is not sensitive to more gradual deceleration. The device is operating at the low end of the ADXL202 sensitivity specifications.

The goals relating to portability and durability were met without difficulty. The entire circuit is small enough for the intended application.

Figure 1 shows the circuitry for the device as built.

Figure 1.



7. Lessons Learned

A major lesson learned that had not been thoroughly learned in any previous course is procedure for troubleshooting a circuit. The most difficult part of the project was figuring out what to try next when the circuit did not perform as expected. Pspice simulations were useful in analyzing the op amp portion of the circuit. The rest of the circuit had to be dealt with by hand. This was different from any lab courses in that it was not possible to know exactly what to expect from any given alteration of the circuit. Nor was it possible to refer to a specific unit of a textbook as a reference. All references used had to be identified from scratch and employed as seemed appropriate.

The major mistakes made fall under the umbrella of not allowing enough time to troubleshoot the circuitry. The suggested improvements are clear in theory but have not been fully developed in the lab. If I had it to do over again, I would not attempt this project during a summer semester.

Before the project began, it was explained that one of the important principles of engineering is to do the hardest part first, since the easy parts are not useful without the rest. One additional thing I learned was that, aside form any specific technical issues, getting the project started is the hardest part. Not having had any experience with electronics, I had trouble bridging the gap between theory and application. Once I got the circuit put together, however, even though it did not work at all initially, I was able to get it working one step at a time.